

# **Climate of Indiana**

## **Introduction**

This publication consists of a narrative that describes some of the principal climatic features and a number of climatological summaries for stations in various geographic regions of the State. The detailed information presented should be sufficient for general use; however, some users may require additional information.

The National Climatic Data Center (NCDC) located in Asheville, North Carolina is authorized to perform special services for other government agencies and for private clients at the expense of the requester. The amount charged in all cases is intended to solely defray the expenses incurred by the government in satisfying such specific requests to the best of its ability. It is essential that requesters furnish the NCDC with a precise statement describing the problem so that a mutual understanding of the specifications is reached.

Unpublished climatological summaries have been prepared for a wide variety of users to fit specific applications. These include wind and temperature studies at airports, heating and cooling degree day information for energy studies, and many others. Tabulations produced as by-products of major products often contain information useful for unrelated special problems.

The Means and Extremes of meteorological variables in the Climatography of the U.S. No.20 series are recorded by observers in the cooperative network. The Normals, Means and Extremes in the Local Climatological Data, annuals are computed from observations taken primarily at airports.

The editor of this publication expresses his thanks to those State Climatologists, who, over the years, have made significant and lasting contributions toward the development of this very useful series.

**State and Station Normals are available at:**

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## **Climate of Indiana**

Topographic Features- Indiana is one of the smallest states in area west of the Appalachian Mountains. Despite its size, the State's natural characteristics exhibit a sharp contrast north to south across its landscape. Indiana topography is characterized by vast flat plains in the northern two-thirds of the State. In the unglaciated south, hills, ridges, knolls, caves and waterfalls abound. A few counties in far west-central Indiana also exhibit the southern topography due to their location in the Wabash River bed. Land elevations range from 324 feet above sea level at the mouth of the Wabash River in the southwest corner of the State to 1,257 feet in far east-central Indiana.

Most of the State is drained by the Wabash River system. The total drainage area of the Wabash is 33,000 square miles, of which 24,000 square miles is in Indiana. Other river basins are the Maumee in the extreme northeast, the St. Joseph (Lake Michigan) and Kankakee (Illinois River) in the north-central and northwest, respectively, while some of the extreme south and southeast drain into the Ohio River.

South-central Indiana has the most rugged terrain and is home to the Hoosier National Forest. The Kankakee Valley in the extreme northwest slopes gently toward the west and drains what were formerly marshlands. Many small lakes abound in northeastern Indiana among numerous glacial moraines and hills. Tourism has become a growing industry in southern Indiana while farming and manufacturing remain important on its northern and central plains.

The characteristics of Indiana soils are important to the needs of farming. The sandy soils of the northernmost counties have a low water holding capacity. Drainage is rapid during rainy periods and flooding is rarely a problem. Some crop irrigation is done in these sandy areas in dry summers.

Rich prairie soils extend over west-central and central Indiana, often producing the State's highest crop yields. Some of the clays in east-central Indiana are compact, with poor drainage and frequent ponding of water, but crop stress due to lack of rain occurs infrequently.

Much of the land in south-central Indiana has a poor water retention capacity due to the underlying limestone. Such areas need frequent rains to sustain proper crop growth and development.

Indiana has an invigorating climate with strongly marked seasons. Winters are often cold, sometimes bitterly so. The transition from cold to hot weather can produce an active spring with thunderstorms and tornadoes. Oppressive humidity and high temperatures arrive in summer. Autumn is favored by many residents as a pleasant time of the year with lower humidity than the other seasons, and mostly sunny skies.

Indiana's location within the continent highly determines its climate. The Gulf of Mexico is a major player in Indiana's climate. Southerly winds from the Gulf of Mexico region readily transport warm, moisture-laden air into the State. The warm, moist air collides with continental polar air brought southward by the jet stream from central and western Canada. A third air mass source found in Indiana originates from the Pacific Ocean. Due to the obstructions posed by the Rocky Mountains, however, this third source arrives less frequently in the State.

A winter may be unusually cold or a summer cool if the influence of polar air is persistent. Similarly, a summer may be unusually warm or a winter mild if air of tropical origin predominates. The interaction between these two air masses of contrasting temperature, humidity and density favors the development of low pressure centers that move generally eastward and frequently pass over or close to the State, resulting in abundant rainfall. These systems are least active in midsummer when they frequently pass north of Indiana.

Weather changes occur every few days as surges of polar air move southward or tropical air northward. These changes are more frequent and pronounced in winter than in summer.

Local climate variations within the State are caused by differences of latitude, terrain, soil type and lakes. For example, the effect of Lake Michigan on the climate of northern Indiana is well-defined in the climate data. This effect is most pronounced just inland from the Lake Michigan shore and diminishes rapidly with distance. Cold air passing over the warmer lake water induces precipitation in the lee of Lake Michigan in autumn and winter. As a result of this phenomenon, heavy winter precipitation, especially snowfall, can extend eastward from Gary inland to as far as Elkhart. Lake-related snowfall and cloudiness can extend to central Indiana in winter, driven by strong northwesterly winds. In the spring, daily maximum temperatures decrease northward in northern Indiana because of the cooling effect of the lake. Average daily minimum temperatures in autumn are higher in northwestern Indiana near the warmer lake surface than farther south.

Temperature- Variations in temperature can occur in short distances where terrain is hilly. On calm, clear nights the valley bottoms have lower temperatures than the slopes and tops of the surrounding hills.

Air temperatures in Indiana have a wide annual range due to the State's location and its natural characteristics. The State's record maximum temperature of 116 degrees Fahrenheit (° F) was set at Collegeville on July 14, 1936. The record minimum temperature is -36° F observed on January 19, 1994 at New Whiteland.

January is typically the coldest month of the year with normal daily maximum temperatures ranging from 31 to 38° F north to south across Indiana. January minima normally range between 15 and 21 north to south. July is the warmest month with daily maxima averaging 80 to 83° F and minima 63 to 65 north to south.

A strong El Niño produces milder than usual winters in Indiana. Prolonged severe hot and cold spells are uncommon in the State.

The dates of the last freezing temperature in spring and the first in autumn vary greatly from year to year. Two-thirds of the time they occur within a 20 to 24 day period centered at the mean date. Across the State, the average date of the last freezing temperature in spring ranges from the second week of April in the extreme southwest to the second week of May in the extreme northeast. The trend of a later date toward the north is reversed in extreme northwestern Indiana, where the average date is about May 1 near Lake Michigan. In autumn, the average date of the first temperature of 32° F or colder is from September 26 in the extreme northeast to October 26 along the Ohio River in the southwest.

Spring freezes end later and autumn freezes begin earlier in valleys and hollows than in elevated areas nearby. The gradual slope of the terrain upward from southwestern Indiana to northeastern Indiana results in lower minimum temperatures and shorter growing seasons in the east compared to the west at the same latitude. Muck soils in northern Indiana transfer soil heat poorly. These soils can freeze as early as late summer, resulting in a shortened growing season. Soil heaving due to frequent freeze and thaw cycles is most problematic in south-central Indiana.

Precipitation- Average annual precipitation ranges from 37 inches in northern Indiana to 47 inches in the south. May is the wettest month of the year with average rainfall between four and five inches across the State. Average rainfall decreases slightly as summer progresses. Autumn months are drier with three inches of rainfall typical in each month. In Indiana, winters are the driest time of year with less than three inches of precipitation commonly received each month. February is the driest month of the year statewide, then precipitation increases in March and April as the spring soil moisture recharge season begins. On average, precipitation occurs one in three days in Indiana.

Annual precipitation is adequate, but an uneven distribution in the summer occasionally limits crops. Mild droughts occasionally occur in the summer when evaporation is highest and dependence on rainfall is greatest for crops. Approximately one-third of the annual rainfall flows to the Mississippi or Great Lakes, mainly during cool weather. The soil usually becomes saturated several times during the winter and spring. Groundwater storage is generally abundant in the north and central areas where glacial deposits cover ancient lake beds or streams. An underlying bed of limestone with shallow soils limits groundwater storage in much of south-central Indiana.

Floods occur in some part of the State nearly every year and have occurred in every month of the year. The months of greatest flood frequency are December through April. The primary cause of floods is prolonged periods of heavy rains, although rain falling on snow or frozen ground can be a contributing factor.

Average annual snowfall ranges from 14 inches in southwest Indiana to 76 inches in the north-central "Snowbelt" near Lake Michigan. Snowfall amounts vary greatly from year to year depending on both temperature and the frequency of winter storms. Measurable snow typically begins in late November and ends by early April although the season can begin as early as mid-October and end as late as early May. In warm years, snow may not begin until mid-December. In central and southern Indiana, snowfall amounts increase toward the east due to the higher elevation.

Cloudiness is least in autumn and greatest in winter. The sun is usually visible about 65 percent of daylight hours on summer days but only 30 percent of the time on winter days. The northern part of the State is cloudier than the south, particularly in the winter when the Great Lakes have their greatest effect upon the weather.

During daylight, relative humidity is usually lower in the south than in the north. This is true for all seasons. However, the simultaneous occurrence of high temperatures and high relative humidity is most frequent in the south. This combination defines the heat index which is often in the uncomfortable zone during much of Indiana summer.

Total evaporation from a water surface in a four-foot diameter tank ranges from six inches at Valparaiso to eight inches at Evansville in July. Evaporation is three or four inches in the north in April and October and a little higher in the south.

Severe storms which damage property and cause loss of life are most frequent in the spring. Indiana has an annual average of 23 reported tornadoes. Indiana tornadoes have occurred in every month of the year. On June 2, 1990, 37 tornadoes ripped through Indiana, the most on any one day in State history. Property damage is greatest from high winds during thunderstorms, while hail occasionally causes loss of crops over small areas during the summer.

Prevailing winds average near 10 mph and travel generally from the southwest during most of the year. Wind speeds in excess of 100 mph have been measured in Indiana near severe storms and tornadoes. During winter months winds prevail from a northerly direction and are more persistent. The land and lake breeze effect is prominent in the summer and the cooling lake breeze tends to reduce daytime maximum temperatures along the Lake Michigan shore and for up to a mile inland.

Climate and the Economy- Indiana has a range in latitude from 38 to nearly 42° North, which provides a climate suitable for a variety of crops. Corn, soybeans and wheat are the most important crops in the State. Tomatoes, strawberries and melons are grown commercially in the southwest where the growing season is the State's longest. Tobacco is grown in the extreme southeast. Fruit is grown in the lower Wabash River basin, but the risk of frost, late spring freezes and severe winter kill must be considered real problems. Beef production is a major operation in the rolling hills of southern Indiana. Agricultural interests have taken advantage of the fairly reliable rainfall and temperatures favorable for crop and vegetative growth.

Several Indiana industries have shown increased interest in evaluating climatic risks, especially public utilities, insurance risk assessors, construction, law enforcement, event organizers and others, all important segments of the Indiana economy. Certainly climate information itself is a valuable commodity and plays an important role in the State economy.